TOSTADA
Data Integration Framework
(TOol using STAcked Data)

2018 NATMEC

David Schrank
Texas A&M Transportation Institute
TOSTADA Concept

– We have a lot of data systems
– We use them for evaluation, decisions, communication
  • Asset management is one organizing device
– We have maps of many systems and data elements
– Can we take advantage of the “silo” expertise?
– Get information and performance measures together?
– Create an information system that “tastes better” than the individual components?
Congestion
Pavement
Bridge
Safety
Freight Value
TOSTADA Opportunities

• Use existing mapped databases to identify locations with multiple deficiencies (e.g., pavement, bridge, congestion, safety) or opportunities (high freight value, developer interests)

• Project Scoping & Risk Management
  – What problems to attack?
  – Where and when to invest?

• Better communicate benefits of treatments (estimate full range of benefits)

• Example: Pavement treatments that improve safety and truck ride quality

• Identify future conditions from investment scenarios

• Examine resiliency of system under AV/CV scenarios
TOSTADA Elements

Bridges – good / fair
Pavement – good
Congestion – high
Freight Value – medium
Safety – very high / high

Right-Sizing Decision?

- How do conditions change in future with different investment levels?
- Plan a new project??
- Operational treatment?
- Access Management?
Concept Use Cases
How does this look in practice?

• ”Easy Button” Results:
  – Find problems using technical criteria for each layer (e.g., good lettuce has different characteristics than good chicken)
  – Communicate benefits across multiple assets or performance categories (e.g., pavement projects have safety benefits)
Concept Use Cases
How does this look in practice?

• “Easy Button” Results:
  – Find problems using technical criteria for each layer (e.g., good lettuce has different characteristics than good chicken)
  – Communicate benefits across multiple assets or performance categories (e.g., pavement projects have safety benefits)

• More Complicated Uses
  – What projects are selected?
  – How much funding in each category?
  – Future effect of treatments on conditions or performance?
  – Estimate benefit/cost of projects
  – Need to determine “crosswalk” – to identify similar damage or cost or performance/condition so that technical criteria can be compared on equal basis (so “red” means the same across all layers)
TOSTADA BITE
(Basic Integration of TOSTADA Elements)

• Because you aren’t hungry enough
• Composite index - combine indices for e.g., congestion, safety, pavement conditions, bridge conditions, freight value) in a standardized way.
• A weighted average of scaled indices
  – Scale individual indices – similar problem levels, similar cost to repair??
  – Normalize the ranges across multiple map layers
  – Weights could also vary depending on the specific uses of BITE (e.g., equal weight or choose weights of each index).
Annual Delay per Mile

Legend

- No Data
- L. T. 75,000
- 75,000 To 125,000
- 125,000 To 225,000
- G.T. 225,000

I 695 Tostada
Annual Congestion Cost

Legend

- No Data
- L.T. 100,000
- 100,000 To 250,000
- 250,000 To 400,000
- G.T. 400,000

I 695 Tostada
Pavement – Intl. Roughness Index

I 695 Tostada

Legend

- No Data
- L.T. 70
- 70 To 100
- 100 To 120
- G.T. 120

Texas A&M Transportation Institute
Bridge Condition

I 695 Tostada

Legend

- No Data
- G.T. 8
- 7 To 8
- 5 To 6
- 3 To 4
- Is 4
Injury Crashes

I 695 Tostada

Legend

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Data</td>
<td></td>
</tr>
<tr>
<td>1 to 0</td>
<td></td>
</tr>
<tr>
<td>0 to 4</td>
<td></td>
</tr>
<tr>
<td>4 to 8</td>
<td></td>
</tr>
</tbody>
</table>
Annual Truck Commodity ($Million)

Legend
- No Data
- L.T. 40,000
- 40,000 To 50,000
- 50,000 To 60,000
- G.T. 60,000
Underlying Indices For BITE (Example!!)

• $I$: Individual indices (example of ranges):
  – Some open ended – some closed range
  – Delay per mile (thousands and millions)
  – Truck Value (millions of dollars)
  – Pavement IRI (tens to few hundred)
  – InjuryCrash (0-7)
  – BridgeCondition (4-9)

• Rescaled indices (example):(Lets just say there is math)

\[
TruckValue^* = \frac{TruckValue - 25000}{80000 - 25000} \times 100, \quad IRI^* = \frac{IRI - 47}{171 - 47} \times 100, \quad dlymce^* = \frac{dlymce - 3217}{541000 - 3217} \times 100,
\]

\[
InjuryCrash^* = \frac{InjuryCrash - 0}{7 - 0} \times 100, \quad BridgeCondition^* = \frac{BridgeCondition - 4}{9 - 4} \times 100, \quad I^* = \frac{I - \min(I)}{\max(I) - \min(I)} \times 100
\]
Annual Delay per Mile (section)
Annual Congestion Cost (section)
Pavement – IRI (section)
Bridge Condition (section)
Injury Crashes (section)
Truck Commodity-$Mil (section)
BITE Results

• Congestion, Truck Val, Crash, Pavement, Bridge
• Segment
  – MP 6.5 to 6.6 (AADT - 186,350)
  – MP 2.1 to 2.17 (AADT - 180,793)
  – MP 24.76 to 24.86 (AADT - 150,600)
• Section
  – Section 5 (4.6 mi, AADT - 202,543)
  – Section 3 (3.9 mi, AADT - 193,281)
  – Section 4 (1.4 mi, AADT - 186,350)
BITE Results

- Congestion
- Segment
  - MP 7.67 to 7.7 (AADT - 208,062)
  - MP 25.92 to 25.94 (AADT - 171,230)
  - MP 7.65 to 7.66 (AADT - 216,280)
- Section
  - Section 4 (1.4 mi, AADT - 186,350)
  - Section 5 (4.6 mi, AADT - 202,543)
  - Section 8 (5.4 mi, AADT - 155,376)
BITE Results

• Congestion / Truck Value
  • Segment
    – MP 7.67 to 7.7 (AADT - 208,062)
    – MP 7.65 to 7.66 (AADT - 216,280)
    – MP 7.66 to 7.67 (AADT - 208,062)
  • Section
    – Section 5 (4.6 mi, AADT - 202,543)
    – Section 8 (5.4 mi, AADT - 155,376)
    – Section 6 (5.2 mi, AADT - 183,195)
BITE Results

• Truck Value, Pavement
  • Segment
    – MP 2.4 to 2.464 (AADT - 187,230)
    – MP 2.1 to 2.17 (AADT - 180,793)
    – MP 2.17 to 2.19 (AADT - 180,793)
  • Section
    – Section 5 (4.6 mi, AADT - 202,543)
    – Section 1 (1.9 mi, AADT - 138,147)
    – Section 3 (3.9 mi, AADT - 193,281)
What’s Next?

• Bring datasets together - Utilize available data
• Take advantage of focus on performance measurement
• Potential uses
  – Find candidate project locations and communicate benefits
  – Score potential projects across condition and performance outcomes
  – Calculate economic benefits and B/C ratios
  – Use this approach for “after” studies
  – Study future investment and travel demand option scenarios
• Improve transparency and consistency for decision-making
TOSTADA
Data Integration Framework
(Tool using STACKed Data)

2018 NATMEC

David Schrank
Texas A&M Transportation Institute
d-schrank@tti.tamu.edu